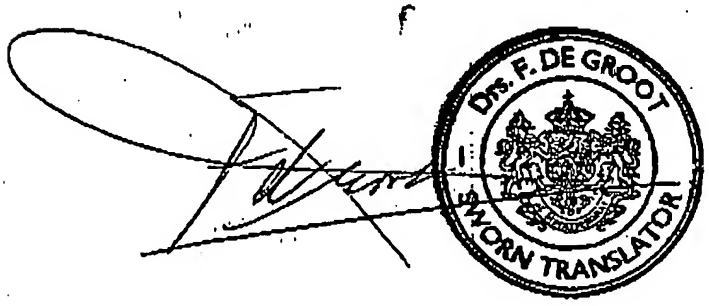
# CERTIFICATION

I, drs. F. de Groot, a sworn translator of Dutch nationality,
of J. Boezerstraat 83, 2552 DL DEN HAAG, the Netherlands,
do hereby declare that, to the best of my knowledge and belief, the
attached translation verified by me is a true and accurate
translation of French patent specification FR 1 216 484 .

Signed this 28th day of November, 2005



CMJ/MBX P53221US00

**-translation of French patent 1.216.484-**

Title: Release valve for compressed or liquefied gas or any other fluid.

The great majority of release valves used nowadays, used for releasing at a low pressure gases or other fluids which are compressed at high pressure or are liquefied, are release valves with membranes, these membranes being connected to a closing punch of the inlet of the highly fluid under high pressure.
These release valves present great drawbacks because they comprise particularly fragile parts that require frequent maintenance and replacement (membrane, punch and its seat). Further, the membrane only allows a relatively small displacement of the punch; to obtain a great displacement, a membrane with a great diameter is to be used, leading to unacceptable obstacles. Finally, the membrane manufactured from rubber or supple and resilient plastic is subject to aging which, after and undetermined period of time, leads to operational malfunction.

With membrane valves used nowadays, the path travelled by the gas is curved and the gas flow undergoes considerable deformations leading to an imperfect operation.

Recently, it has been suggested to realize release valves without membranes, of which all elements are coaxial, but these valves were of relatively complicated construction; they also comprised a punch and a seat, as did their predecessors, which are fragile parts requiring frequent replacement.
Furthermore, the closing valve with punch was placed in the high-pressure part of the release valve, as was the case with valves with membranes, which had unpleasant and even very serious consequences in case of explosions, as the punch did not close automatically.

The object of the present invention is a release valve with which the above-mentioned drawbacks can be avoided, while, at the same time, this release valve forms, a check valve which does not comprise any fragile parts, needs little space, is robust and accurate, and moreover has a simple and inexpensive construction, as will appear from the following description of an method of the invention.

With respect to earlier release valves, this release valve presents the following characteristics which are discussed separately or according to any combination:

1. the closing valve is placed in the low-pressure part of the release valve;
2. the release valve comprises a piston whose central part serves directly as closing valve;
3. Said piston is not only, on one side, in contact with the release spring, but is also subject, on the other side, to the action of a closing spring;
4. The central part of the piston, a part that forms the closing valve, comes to lie, in the closing position, against a surface of a toric air-tight ring between said piston and the inlet element of the high-pressure fluid, the toric ring being slightly squeezed when the valve is in its complete closing position;

5. This squeezing is limited by a stop, borne by the inlet element of the high-pressure fluid, a stop against which the internal surface of the closing valve comes to lie;

6. The piston comprises in its central part a crown of holes opposite the front surface of the above-mentioned toric, air-tight ring.

Other characteristics and advantages of the present invention will appear in the following description, which relates to a method of the invention and which will be made with reference to the accompanying drawing. In the drawing:

Figure 1 is an axial cross-section of a release valve designed according to the invention; and

Figure 2 is an exterior view of the same release valve.

As can be seen in the drawing, the release valve comprises a cylindrical body 1 provided with a hexagonal exterior part 2 and cooperating, at the end of a threaded connection, with an inlet pipe 3 for the high-pressure fluid. On this body is screwed a cap 4 also provided with a hexagonal outer part 5 which presents a threaded outlet pipe 6 for connection to the utilizing apparatus.

In the body 1, a piston 7 can glide, guided, on the one side, by the internal part of the body 1 and, on the other side, by the extremity of the inlet pipe 3. On one side, the piston is in contact with an extremity of a release spring whose other extremity bears against a series of control buttons 9 movable in openings provided in the heart of the body 1. These buttons can be moved for determining a particular tension of the release spring 8 (which, for the closing position of the release valve, is free of all compression), by means of a control nut 10 which is screwed on the threaded end of the inlet pipe 3.

On the other side of the piston 7, a closing spring 11 is provided having a predetermined tension when the release valve is in closed position. Furthermore, the central part of said piston forms a direct closing valve when it comes to abut against a toric, air-tight ring 12 which, in the closing position, is slightly squeezed in its housing provided at the extremity of the inlet pipe 3, while the squeezing action is limited by the stop, formed at the extremity of this pipe and against which the internal surface of the central part of the piston 7 comes to abut in completely closed position. This air-tight ring 12 thus forms, with its front side, an air-tight seat for the closing valve and an air-tight connection between the piston 7 and the inlet pipe 3. Opposite this toric ring 12, the piston 7 has a crown of holes 13 for the passage of fluid when the valve is open.

Finally, the release valve comprises another toric, air-tight ring 14 with great diameter to ensure the air-tightness of the device at the low-pressure side. Presently, the operation of the above-described release valve will be described, which release valve is mounted, by a threaded extremity of the pipe 3, on a high-pressure bottle or pipe, and which feeds, under low pressure a utilizing apparatus plugged into the threaded end 6 of the cap 4.

In the closing position, the internal central surface of the piston 7 comes in contact, through the thrust of the closing spring 11, with the external surface of the air-tight ring 12, while the tension of the spring is slightly higher than the force caused by the gas contained in the central tube 3. The ring 12 is slightly squeezed while its squeezing is limited by the front nose of the pipe 3 against which the internal surface of the piston 7 comes to abut. The release spring 8 is clear, without contact or clamping, when the apparatus is closed.

To open the release valve, the control nut 10 is screwed on by means of its outside knurled ring 15. The forward movement of the nut is transmitted by the series of buttons 9 to the release spring 8 which finds itself pushed into contact in the internal housing of the piston 7 and is thus put under a controllable tension, which control is effected by the extended or less extended screwing on of the nut 10 on the pipe 3.

Furthermore, the holes receiving the buttons 9 allow the evacuation of air contained in the cavity of the body 1 and establish the equilibrium with the atmosphere.

In this position, the valve formed by the central part of the piston 7 opens and the gas flows through holes 13 to the low-pressure part and from there to the utilizing apparatus. The air-tightness in the low-pressure part is effected by the toric ring 14.

When the user interrupts the flow rate of the fluid, the disequilibrium effected by the difference of forces present which are applied to the piston 7, a disequilibrium which is judiciously controlled due to the dimensions of the sections between the high-pressure and low-pressure parts, returns the piston 7, due to flexibility, to contact the surface of the toric connection 12. The release valve is thus closed.

As can be seen in Fig. 2, a graduation 16 can be arranged on the body 1 to indicate to the user the different pressures obtained in the low-pressure part of the release valve according to the forward movement of the control nut 10, so that in this manner the use of low-pressure manometers, which is always fragile and expensive, can be avoided. The numbers indicated in Fig. 2 are conventional indications but if so desired they can be replaced by pressure indications in, for instance, $kg/cm^2$.

The type of release valve described hereinabove can be realized for all pressures. Adaptation of, on the one side, the sections of passage and, on the other side, the variable forces of the release spring 8 suffices.

For some uses, a so-called "open" release valve is preferred. The release valve described hereinabove meets this need in a simple manner. In order to realise such a type of release valve, it is indeed sufficient to remove the closing spring 11. Then, closure is no longer ensured because the valve remains between the closed and the completely opened position, and the pressure acting on the piston 7 at the moment the gas at high pressure arrives ensures the gliding of the piston and the flow rate of the gas.

The release valve described hereinabove can also be used in a simple manner to realise a valve of the "fixed and open release" type. In this case, also the closing spring 11 is omitted, but furthermore, the control nut 10 and the buttons 9. Then, the release spring is adjusted under constant tension according to an appropriate screwing on. Thus, an open release valve with specific constant pressure is obtained.

It is clear from the foregoing that a release valve without membrane or punch is realized, that is to say, without fragile parts which require frequent replacement, therefore robust and always accurate. It is also clear that all elements of the release valve are coaxial and that consequently, no appreciable deformation of the gas flow is formed, which results in a perfect functioning and allows a practical and economic manufacture of the different elements.

Furthermore, it is clear that this release valve is of a particularly simple and economical construction and that it takes up little space, whatever the conditions of use.

Finally, the release valve which forms the object of the invention has the important advantage that it forms an excellent check valve, due to the constituent parts and of the arrangement of the closing valve in the low-pressure part of the release valve. The fact is that a sudden and dangerous increase of pressure which may occur following, for instance, a blow in the pipe connected to the pipe attached to the outflow of the release valve, pushes the piston 7 back all the more forcefully on to the toric air-tight ring 12.

This is merely an example of an advantage of the valve in question, because it also functions as check valve in all cases of untimely increase of pressures.

In certain cases, the release valve described hereinabove can also function as safety valve.

In rest, the release valve is closed even though it is subject to pressure from the pipe. The setting of the spring 11 is set slightly below the pressure prevailing in the central channel of the release valve.

If, for whatever reason, this pressure increases and obtains a value above the setting of the spring 11, the piston 7 moves; then the release valve opens and forms an excellent safety valve for the entire pipe.

Naturally, the release valve described hereinabove is merely an exemplary embodiment of the invention. Certain modifications in design details are possible without the general structure of the invention being altered thereby.

## ABSTRACT

The object of the present invention is to provide improvements to release valves for compressed or liquefied fluids. This invention presents the following characteristics, taken separately or in various combinations:

1. The closing valve is placed in the low-pressure part of the release valve;
2. The release valve comprises a piston whose central part serves directly as closing valve;
3. Said piston is not only, on one side, in contact with the release spring, but is also subject, on the other side, to the action of a closing spring;
4. The central part of the piston, a part that forms the closing valve, comes to lie, in the closing position, against one surface of a toric air-tight ring between said piston and the inlet element of the high pressure fluid, said toric ring being slightly squeezed when the valve is in its complete closing position;
5. This squeezing limited by a stop, borne by the inlet element of the high-pressure fluid, a stop against which the internal surface of the closing valve comes to lie;
6. The piston comprises in its central part a crown of holes opposite the front surface of the above-mentioned toric, air-tight ring.